DOCUMENT RESUME

ED 323 233 TM 015 438

AUTHOR Lavely, Carolyn; And Others
TITLE Florida Master Teacher Program: Testing Teacher Subject Matter Knowledge.
PUB DATE 86
NOTE 17p.
PUB TYPE Journal Articles (080) -- Reports - Evaluative/Feasibility (142)
JOURNAL CIT Florida Journal of Educational Research; v28 n1 p83-97 Fall 1986

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Elementary School Teachers; Elementary Secondary Education; Higher Education; *Knowledge Level; *Master Teachers; Mastery Tests; Psychometrics; Secondary School Teachers; *State Programs; *Teacher Characteristics; Teacher Education; Teacher Evaluation; Test Construction; *Testing Programs; Test Interpretation; Test Validity
IDENTIFIERS *Florida Master Teacher Program; *Subject Content Knowledge; Teacher Testing

ABSTRACT

The efforts of the Florida Institute for Instructional Research and Practice in designing, developing, and analyzing the subject area knowledge tests of the Florida Master Teacher Program are described. A total of 13 subject area examinations was developed in 1984-85, and 5 additional tests were developed the following year. For each subject area a nine-member writing task force and a nine-member validation team were formed. The development process helped ensure the content validity of the tests. A full-scale field test was not conducted prior to the first administration of each test, so intensive analyses of first administration data were performed before examinee score reports were prepared. Alternative test forms were prepared for the second test, and a plan was developed for linear equating of examinee scores in 1985-86. The psychometric qualities of the developed tests are presented. Characteristics of teachers earning the designation of Associate Master Teacher are profiled. Future directions in testing teachers' subject matter knowledge are discussed, with emphasis on the provisions of the Raymond B. Stewart Career Achievement Program Act of 1986. Three data tables are included. (SLD)

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FLORIDA MASTER TEACHER PROGRAM: TESTING TEACHER SUBJECT MATTER KNOWLEDGE

Carolyn Lavely, Tom Fisher,
Neal Berger, Donna Bullock,
Constance Hines, and Shlomo Sawilowsky

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Florida Journal of Educational Research
Fall 1986, Vol. 28, No. 1, Pp. 83-97

Florida Master Teacher Program: Testing Teacher Subject Matter Knowledge

Carolyn Lavely, Tom Fisher, Neal Berger, Donna Bullock, Constance Hines, and Shlomo Sawilowsky

ABSTRACT. The design and development of subject matter tests for the Florida Master Teacher Program are described. The psychometric qualities of each test and a profile of teachers earning the designation of Associate Master Teacher are presented. Florida's future directions in testing teachers' subject matter knowledge are discussed, particularly through the Raymond B. Stewart Career Achievement Program act of 1986.

Background

During the past ten years the State of Florida has invested considerable effort and resources in improving its public school program. One focus of these efforts has been on teachers through minimum competency requirements for new teachers, the Beginning Teacher Program, and the Florida Master Teacher Program. This paper describes the Institute for Instructional Research and Practice's (IIRP) efforts in designing, developing, and analyzing the subject area knowledge tests for the Florida Master Teacher Program.

Many educators believe that teachers' mastery of their subject matter is of primary importance. In fact, most believe that it is a necessary condition for excellence in student achievement (Shulman, 1986; Stephens, 1967). Goodison (1986) summarized this perspective by pointing out that teachers cannot teach what they do not know. In this vein, the 1983 Florida

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Legislature created the Florida Meritorious Personnel Program to identify, reward, and hopefully retain superior personnel in the public schools. One requirement of the program was for candidates to pass, with high standing, a subject matter test in their area of assignment.

The 1984 Florida Legislature substantially rewrote the initial program and renamed it the Florida Master Teacher Program. The revised program defined the criteria for becoming an Associate Master Teacher or a Master Teacher as follows:

1. To qualify as an Associate Master Teacher (AMT), a teacher must have four years teaching experience of which two years minimum must be in-state; document either an infield masters degree or its equivalent or document a superior score on a subject area examination approved an examination by the State Board of Education; document a superior performance evaluation on a SBE approved evaluation instrument administered by the principal.
2. To qualify as a Master Teacher (MT), the teacher would need to have completed seven years of teaching, hold a professional service or continuing contract, and have served three years as an AMT.

Additionally, the 1984 Legislature created the Institute for Instructional Research and Practice and assigned it three main purposes: (1) to conduct and assemble research to validate subject area knowledge for instructional personnel; (2) to conduct and assemble research related to teacher performance; and (3) to conduct and assemble research related to student performance.

In October, 1984, the State Board of Education approved the amended version of the rules for the Florida Master Teacher Program. The main provisions for the subject area examinations are the following:

1. Subject area examinations are defined as a standardized assessment process that measures the candidate's knowledge of the appropriate subject area.

2. The institute is to validate subject areas and examinations.
3. The examinations shall be administered by test administration agencies under contract with the Department of education.
4. A superior score shall be at or above the 75th percentile.

The Test Development Process

The development of subject area examinations began with the selection of content areas to be tested. Using data provided by the Florida Department of Education about the number of teachers by teaching assignments, the Institute staff and consultants selected nine areas for initial testing. These areas were Business Education, Elementary Education, English, Exceptional Child Education, Gifted Education, Music, Mathematics, Science, and Spanish. Later, Science was divided into Biology, Chemistry, Earth Science, General Science and Physics. Thus, a total of 13 subject area examinations was developed in 1984/1985. During the second year of the program, five additional tests were developed including Art Education, Speech and Language Disorders, Home Economics, Reading, and School Psychology.

For each subject area chosen, two, nine-member groups were formed: a writing task force and a validation team. The writing task force's responsibilities included developing, reviewing, and revising the domain analyses, test blueprints, item specifications, and test items. The validation teams' responsibilities included providing an external review and evaluation of each of the documents produced by the writing teams, as well as the final tests. The recommendations of the validation teams were used by the writing teams to refine the documents.

Criteria for membership in each group included expertise in content and/or measurement as well as representation by region and ethnic group. Recommendations for members were solicited from professional teacher organizations and unions; education associations and administrators of schools and colleges throughout the state. The teams formed consisted of

a majority of classroom teachers. Table 1 shows the representation of writing task forces and validation teams for the 1984-85 and the 1985-86 groups.

The first task was the development and validation of test blueprints. The test blueprints defined each subject area domain to be tested. Each blueprint was a two-way matrix with one dimension that listed weighted topics and subtopics and another that identified the cognitive skill levels to be measured. The following three-element cognitive skill taxonomy (Ward, 1983) was used: (1) recognition which is remembering or simple recall; (2) application which involves the classification and interpretation of information, concepts, principles, and procedures; and (3) problem solving which requires the integration of principles, rules, or laws, and evaluation. The blueprint was used to prescribe the tests' balance across topics and across cognitive skill levels for each topic.

The following sequence of activities was used to produce each test blueprint. First, writing task forces received training in the purposes for and characteristics of test blueprints. After instruction, they produced the first blueprint drafts, which were critiqued and revised by Institute staff and expert consultants. Given this feedback, task forces revised and refined the blueprints. After completion, the appropriate external validation team critiqued each blueprint using a prescribed Domain Plan (IIRP, 1984a) and Test Blueprint Review Form (IIRP, 1984b). The criteria for review included job relatedness, completeness, balance, and bias. Based on their judgments, the test blueprints were again revised by the writing task force.

The second task was to develop item specifications. Multiple choice items were prescribed for their versatility, objectivity, and economy. The specifications were to define each skill to be measured, delineate the stimulus and response attributes of the items, describe scoring procedures, and present a model item. Following instruction in developing item specifications, the writing task forces developed item specifications congruent with the test blueprints. These specifications were reviewed and revised by

TABLE 1

The Composition of Writing Task Forces and Validation Teams

Membership	Writing Task Forces 1984-85	Writing Task Forces 1985-86	Validation Teams 1985-86	Validation Teams 1985-86
Schools				
Community Colleges	2	0	3	2
School Districts	18	12	22	15
Universities	7	3	9	5
Individuals				
Community College Teachers	2	0	3	2
Teachers K-12	52	11	44	20
School District Supervisors	11	14	15	16
Professors	30	5	9	8

Institute staff and consultants. After specifications were completed, they were critiqued by the appropriate validation team using the prescribed Item Specifications Review Form (IIRP, 1984c). Each part of the specification, including the skill statement, stimulus attributes, response attributes, and scoring procedures, was judged as either acceptable, needs revision or unacceptable.

Due to the large volume of item specifications to be reviewed, each validation team was divided into two-member mini-teams. Each mini-team was assigned to critique a number of specifications. If agreement could not be reached on any specification, it was subjected to review by the full validation team. Each mini-team presented its overall impressions of the item specifications to the full validation team. These team critiques were communicated to the coordinators of the appropriate writing task forces. The writing task forces then made the recommended revisions in the item specifications.

The third task was to write the items according to the specifications. Following instruction in item writing, each writing task force was charged with writing three times the number of prescribed items, and each group produced an item pool of between 350 and 500 items. Two separate reviews were used to critique these items. First, all the writing task forces were assembled and assigned to small groups to conduct an internal review under the direction of Institute Staff and observation by Department of Education personnel. Using the Internal Review Form for Multiple Choice Items (IIRP, 1984d), each group examined its assigned items using the following criteria: consistency with item specifications, clarity, correctness of the keyed answer, plausibility of distractors, grammatical correctness, difficulty, freedom from bias, and other characteristics. The writing teams corrected those items judged inadequate. Second, the appropriate external validation teams used the same procedures and criteria to critique the items and to select a set of items from the pool for pilot testing.

The fourth task was to field test the chosen items and then select the best ones for the final version of the test. The items chosen for the field test were

administered to teachers in private schools and to upper-level undergraduates nearing completion of their studies. A full scale field test was not conducted although this is desirable in developing new testing programs. One reason for this omission was that a full scale field test should involve examinees who are similar in characteristics to the intended population, and members of the intended population might choose to take the exam. This would affect the tests' security. Although there are strategies to overcome this hindrance, sufficient time was not available under the timelines prescribed by the legislation.

Following administration of the items to the two groups, item data were compiled and used to identify and eliminate faulty items. For each content area, those items judged best were selected for inclusion on the final subject area tests. At this point, validation teams were reassembled to critique and validate the completed test forms. Following any necessary refinements, camera ready copies of the tests were produced and delivered to Educational Testing Service in Princeton, New Jersey for printing and administration.

The Tests' Content Validity and Reliability

The development process that was used helps to ensure the content validity of the tests. Nunnally (1978) recommends that the content validity of a test be judged by the plan and procedures of construction rather than by other methods after tests are constructed and administered. Support for the content validity of these tests is provided from several sources. In a position paper on the process used to develop these subject area tests (IIRP, 1986), three external, out-of-state consultants, Mehrens, Solomon, and Miller concluded that:

> We know of no organization that has constructed such quality examinations in the timeframe and with the resources available. In fact, we really do not see how any organization could have proceeded in any better fashion. (p. 2)

> What inference do we wish to draw from the tests? Simply that those who score above the 75th percentile are in the upper quartile of the teachers who took the tests on knowledge of the content domain which was sampled in the tests. The method of constructing the domain insured a relevant domain while the method of item construction insured that the items did, in fact, sample that domain... That is sufficient for the current use of the test. (pp. 33-34)

The State Board of Education commissioned an external, independent evaluation of the tests by MGT of America, Inc. In their report (MGT of America, Inc., 1985) they concluded that:

> The process outlined by the measurement consultants and Institute staff was sufficiently rigorous to assure content validity. (Ch. 3, p. 8)

> In terms of the definition of what constitutes an Associate Master Teacher, these tests do have content validity. That is, these tests do enable the Department of Education to identify those teachers who have superior knowledge of the content domain. (Ch. 3, p. 10)

The first administration of the original set of subject area examinations occurred in March, 1985, and the second administration was in January, 1986. The second set of subject area exams were administered in March and April of 1986. From these administrations, the reliability of each test was tabulated. Table 2 contains measures of reliability using the Kuder-Richardson (KR-20) index of internal consistency and the Brennan-Kane (B-K) index of dependability (Brennan and Kane, 1977). This table also includes the standard error of measurement for each test (SEM); the number of examinees; the mean; and the standard deviation for each test.

The Kuder-Richardson index reflects the homogeneity of the items in a test. All tests but two, SLD and Gifted Education had internal consistency reliability coefficients greater than .80, demonstrating a high level of reliability for newly-constructed instruments (Ebel, 1972). The Brennan-Kane Index of Dependability (B-K) is useful in deciding whether an examinee is truly above or below the cutting score. The B-K indices ranged from .80 to .97 indicating a high degree of dependability at the cutting score.

Continued Item Analysis After Test Administration

Since a full scale field test was not conducted prior to the first administration of each test, extensive analyses of the first administration data were performed prior to preparing examinee score reports. The following criteria were used to score items for additional review:

1. $\underline{p}$ values less than .50
2. one or more distractors selected as frequently or more frequently than the keyed option
3. negative or very low point-biserial correlations
4. one or more examinees questioning the item during the test
5. divergent $\underline{p}$ values for Black and White examinees
6. divergent $\underline{p}$ values for Hispanic and White examinees

Following these data analyses, the Institute developed alternative test forms to be used in the second test administrations. In addition, a plan for linear equating examinee scores was developed for scoring the tests in 1985-86. This plan is based on Angoff's (1971) Design IV, subdesign (a).

TABLE 2

Means, Standard Deviations, and Reliability Statistics By Test

				Reliability Statistics		
TEST	N	M	SD	KR-20	B-K	SEM
Art[a]	282	79.7	10.1	.83	.79	4.20
Business Education	560	64.6	15.6	.90	.93	4.93
Communication Disorders[a]	316	84.1	9.7	.82	.78	4.14
Elementary Ed.	7143	71.9	14.7	.90	.89	4.65
English	1734	71.9	9.5	.82	.80	4.01
Exceptional Child						
1. EMH	264	71.6	11.3	.83	.82	4.66
2. MH	435	69.5	12.9	.87	.87	4.66
3. SLD	821	73.0	9.5	.78	.75	4.47
Gifted Education	375	69.8	7.6	.64	.84	4.54
Home Economics[a]	216	88.3	12.4	.87	.83	4.24
Mathematics:						
1. Jr. High[b]	703	52.1	15.91	.95	.96	4.21
2. Sr. High[b]	820	73.1	15.4	.95	.96	3.78
Music	525	69.5	9.2	.82	.83	3.91
Reading[a]	378	88.3	12.4	.87	.86	4.55
School Psychology[a]	142	79.4	11.7	.86	.86	4.37
Science:						
1. Biology	489	56.9	12.2	.87	.95	4.40
2. Chemistry	171	71.6	11.6	.90	.89	3.69
3. Earth	102	68.5	11.4	.86	.87	4.25
4. General Science	405	51.6	11.2	.83	.97	4.60
5. Physics	66	78.9	10.1	.89	.88	3.36
Spanish	231	72.5	10.0	.89	.87	3.31

Note: [a] Tests developed and administered in 1985-86.
[b] KR-20 and B-K indices for these tests were obtained from combined Sr. and Jr. High Math data.

Characteristics of Florida's Associate Master Teachers from the 1984-85 Tests

The characteristics of those teachers who were designated as Associate Master Teachers for 1984-85 are reported in Table 3 by school district. Column 2 shows the number of teachers (N) in each district who took each examination and column 3 indicates the number of teachers in each district who were designated Associate Master Teachers (AMT). The remaining columns report the number of award recipients by gender (columns 4-5), ethnic group (columns 6-8), and areas and levels of certification (columns 9-10). Column 9 shows the number of Associate Master Teachers who are certified to teach in multiple areas (MCA), and column 10 shows the number certified to teach at multiple levels, i.e., both elementary and middle school or both middle and high school.

Note in the table that those designated as Associate Master Teachers were proportionally distributed throughout the state, with few exceptions, and that 91 percent of the group was classroom teachers. Through additional analyses, it was found that the mean number of years of teaching experience for Associate Master Teachers was 14.3, 12.6, and 4.5 years, total, in-state, and out-of-state, respectively. By comparison, the mean number of years of teaching experience for teachers not earning this distinction was 14.6, 12.8, and 5.2, total, in-state, and out-of-state, respectively. These nearly identical profiles indicate that the amount of teaching experience per se does not alone significantly affect teachers' knowledge and skill in their content areas.

Future Directions of Subject Area Teacher Testing in Florida

For many reasons, the Master Teacher Program was criticized during its first year of operation. Consequently, the Legislature required the Department of Education to oversee an independent evaluation of all aspects of the program. This was accomplished through a contract with MGT of America, Inc. of

TABLE 3.

Characteristics of Florida's Associate Master Teachers (1984-85)

			GENDER[a]		ETHNIC GROUP[b]			CERT.[c]		
DISTRICT	N	AMT	M	F	B	H	W	MCA	MCL	% CT[d]
Alachua	408	55	4	51	0	1	53	43	19	94
Baker	38	7	1	6	0	0	7	4	3	71
Bay	286	40	5	35	0	1	39	31	21	88
Bradford	52	11	3	8	0	0	11	10	10	100
Brevard	872	102	18	83	1	0	100	72	58	94
Broward	2335	483	83	397	16	12	442	357	279	88
Calhoun	25	2	0	2	0	0	2	2	2	100
Charlotte	71	9	3	6	0	0	9	8	8	56
Citrus	136	35	8	27	0	0	35	65	18	91
Clay	304	30	5	25	0	0	30	19	13	93
Collier	218	17	5	12	0	0	17	10	17	76
Columbia	89	14	3	11	0	0	14	11	7	93
Dade	2749	394	104	288	11	39	333	293	239	91
Desoto	24	1	0	1	0	0	1	1	1	100
Dixie	16	1	0	1	0	0	1	0	0	100
Duval	1153	130	16	114	8	1	130	94	72	92
Escambia	816	241	51	189	14	1	234	160	130	84
Flagler	21	6	0	6	1	0	5	5	5	50
Franklin	20	2	0	2	0	0	2	2	2	50
Gadsden	77	8	2	6	0	0	8	6	4	100
Gilchrist	8	3	2	1	0	0	3	2	2	100
Glades	3	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Gulf	11	1	0	1	0	0	1	1	1	0
Hamilton	14	1	0	1	0	0	1	1	1	100
Hardee	40	5	2	3	0	0	5	2	2	100
Hendry	58	12	3	9	0	0	12	9	6	100
Hernando	68	15	3	12	0	0	15	11	9	80
Highland	103	7	3	4	1	0	6	6	5	86
Hillsborough	1353	261	48	212	6	16	239	175	139	93
Holmes	35	2	2	0	0	0	2	2	1	100
Indian River	138	30	3	27	0	0	30	22	19	93
Jackson	147	11	1	10	0	0	11	7	7	91
Jefferson	8	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Lafayette	14	3	0	3	0	0	3	2	1	100
Lake	245	22	5	17	0	0	22	12	8	95
Lee	394	69	16	53	0	0	69	49	34	93
Leon	254	109	20	88	6	2	99	87	74	91
Levy	59	3	0	3	0	0	3	2	2	100
Liberty	19	1	0	1	0	0	1	1	1	100
Madison	24	3	2	1	0	0	3	2	2	100
Manatee	413	68	15	53	0	0	68	44	30	93
Marion	319	72	15	57	6	0	66	55	40	88

TABLE 3. (Continued)

Characteristics of Florida's Associate Master Teachers (1984-85)

DISTRICT	N	AMT	GENDER[a]		ETHNIC GROUP[b]			CERT.[c]		% CT[d]
			M	F	B	H	W	MCA	MCL	
Martin	113	11	2	9	0	0	11	9	9	100
Monroe	149	29	5	24	0	0	78	78	15	93
Nassua	90	11	2	9	0	0	11	8	6	91
Okaloosa	393	84	11	72	0	1	82	13	52	100
Okechobee	52	6	0	6	0	0	6	5	4	100
Orange	930	204	44	159	0	3	201	140	118	95
Osceola	84	13	0	13	0	0	13	9	6	100
Palm Beach	697	89	19	71	6	2	80	70	55	87
Pasco	362	75	17	60	0	0	75	58	51	89
Pinellas	763	151	33	118	2	2	145	106	83	88
Polk	972	99	73	76	2	0	97	68	51	99
Putnam	149	29	9	20	0	0	29	20	19	83
St. John	111	23	5	18	0	0	23	15	8	87
St. Lucie	142	16	3	13	1	0	15	11	9	82
Santa Rosa	190	41	10	31	0	0	41	30	28	95
Sarasota	296	63	14	49	0	0	63	50	38	95
Seminole	554	96	21	75	1	0	95	72	61	95
Sumter	38	5	1	4	0	0	5	3	2	80
Suwannee	52	8	1	7	0	0	8	4	4	100
Taylor	36	8	3	5	0	0	8	5	5	100
Union	7	1	0	1	0	0	1	1	1	100
Volusia	396	70	14	56	1	0	69	57	48	97
Wakulla	34	8	0	8	0	0	8	7	5	88
Walton	34	8	2	6	2	0	6	5	5	100
Washington	25	4	0	4	0	0	4	4	3	100
Fl. S. F.Blind	28	6	2	4	1	0	5	4	4	83
P. K. Young L.	11	3	1	2	0	0	3	2	2	100
Florida Sch. Deaf	8	2	1	1	0	0	2	2	2	100
A. D. Henderson	13	2	0	2	0	0	2	2	1	100
Florida A & M	5	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
TOTAL	20,171	3,451	691	2,749	85	81	3,248	2,504	1,987	91

NOTE:
[a] Gender categories: Male (M) and Female (F).
[b] Ethnic groups: Black (B), Hispanic (H), and Whites (W).
[c] Certification categories: Multiple Certification Areas (MCA) and Multiple Certification Levels (MCL).
[d] Percent of AMT's who are classroom teachers.

Tallahassee, Florida. These independent evaluators concluded, basically, that the idea of merit pay for teachers is workable and that the Legislature should continue to move in that direction.

Subsequently, the 1986 Legislature enacted the Raymond B. Stewart Career Achievement Program for Teachers. This program will go into effect July 1, 1987 and will include subject area examinations, classroom performance evaluations, peer evaluations, and supervisor evaluations. In addition, the Legislature enacted a new teacher certification statute that requires subject examinations in each area of specialty. The Institute for Instructional Research and Practice will continue to be involved in the development of tests to measure teachers' subject matter knowledge in the Career Achievement Program as well as in the certification program. The new program will continue the state's commitment to improving instructional practices in public schools in Florida.

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AUTHORS

NEAL BERGER, Deputy Director, Institute for Instructional Research and Practice, University of South Florida, Tampa, Florida 33620

DONNA BULLOCK, Visiting Associate Professor, Institute for Instructional Research and Practice, University of South Florida, Tampa, Florida 33620

TOM FISHER, Administrator, Student Assessment Services Florida State Department of Education, Tallahassee, Florida 32301

CONSTANCE HINES, Assistant Professor, Department of Educational Measurement and Research, University of South Florida, Tampa, Florida 33620

CAROLYN LAVELY, Professor, Department of Special Education and Director, Institute for Instructional Research and Practice, University of South Florida, Tampa, Florida 33620

SHLOMO SAWILOWSKY, Visiting Assistant Professor, Institute for Instructional Research and Practice, University of South Florida, Tampa, Florida 33620